RIEGL VMX®-RAIL

3 MHz pulse repetition rate, and 750 lines per second resulting in up to 7000 pts/m² in 3m range at 80 km/h platform speed

420m | 3 MHz | optional

The *RIEGL* VMX-RAIL is a fully integrated Mobile Laser Scanning System for track mapping and clearance surveying. The triple scanner system design allows for utmost efficient capturing of dense, accurate, and feature-rich data.

Take advantage of the VMX-RAIL for
- accurate surveying in challenging environments
- reliable capturing of railway infra-structure, topology, and vegetation
- platform speed up to 130 km/h for operation during regular rail schedules
- reduction of scan shadows by triple scanner system design
- flexible camera options to complement scan data with high resolution imaging
- data export to Third-Party Rail-Processing Software Packages
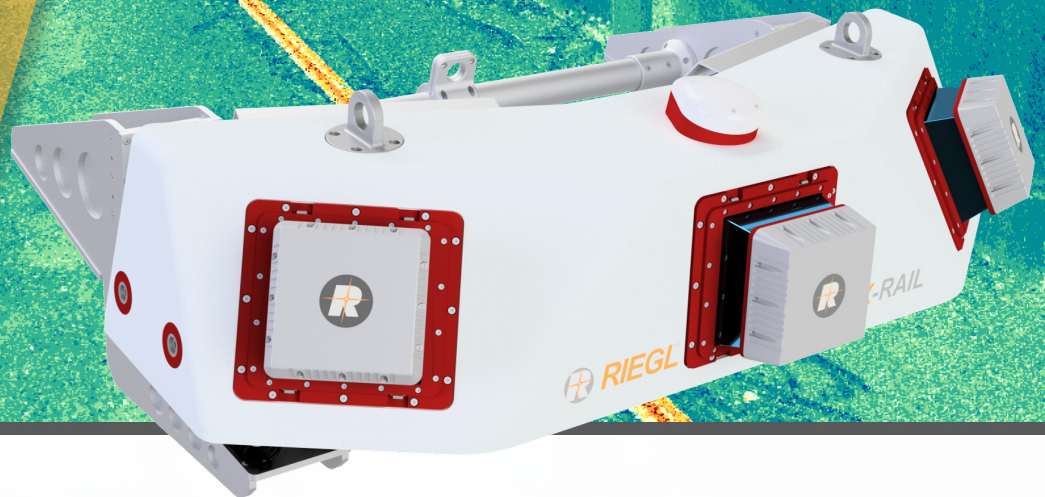
Triple Scanner Mobile Mapping System Specifically Designed for Rail Application

Typical Applications

- Rapid and Safe Data Capture with Minimal Disruption to Network Schedules • Rail Infrastructure Asset Management • As-Built Surveying
- Track and Infrastructure Monitoring • Clash Detection Simulation and Clearance Analysis • Railway Planning and Engineering

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RIEGL®

VMX-RAIL Key Features

- rugged measuring-head for reliable long-term operation in harsh environments

- equipped with 3 VUX-1HA High Accuracy Laser Scanners

- optimized scanner orientation to increase the field of view and to minimize scan shadows

- unique crossed point cloud pattern along 360 deg of the clearance profile for improved feature extraction and small object detection

- 3 MHz pulse repetition rate and 750 lines per second resulting in up to 7000 pts/m^2 in 3m range at 80 km/h platform speed
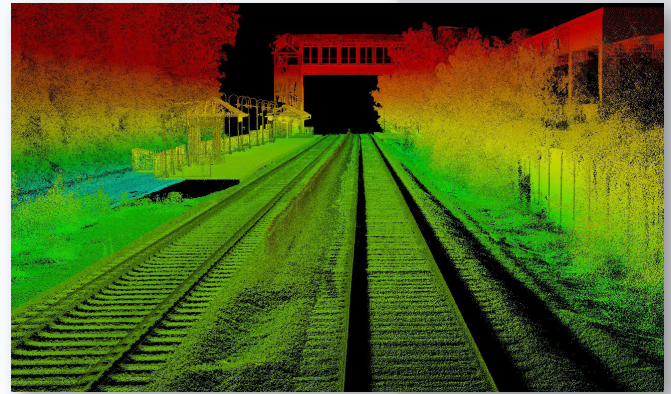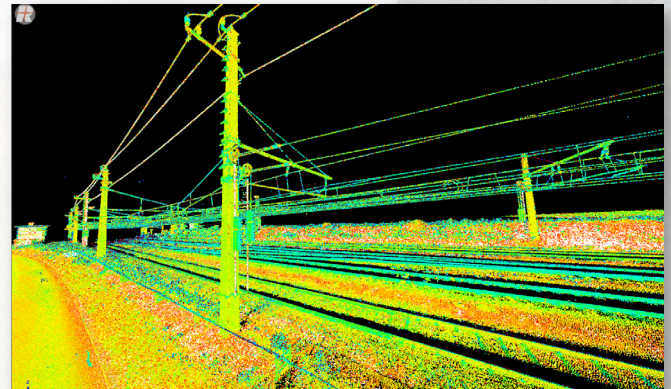

RIEGL VMX scan data

State-of-the-Art
## Track Mapping & Clearance Surveying

RIEGL VMX-RAIL Mobile Laser Scanning System

- enables the capture of the complete rail corridor, including catenary systems, rail heads, and the complete periphery, even signs orthogonal to running direction

- high-end system performance supports rapid data acquisition of dense point clouds

- fully integrated and calibrated measuring head

- optionally integrated camera system and open inferfaces to various external sensors

RIEGL VMX scan data

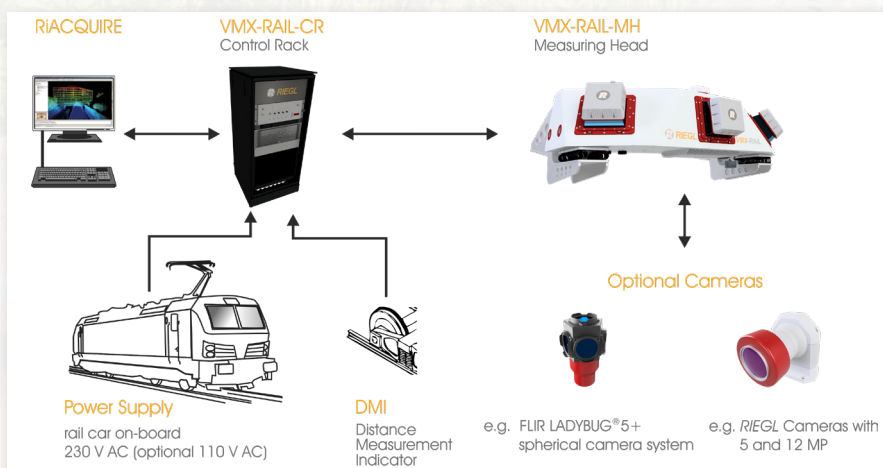| Functionality			
product	extraction of rail axis	extraction of profiles	clearance	track planning
TopoDOT®	✔	✔	✔	with Bentley Rail
CARD/1	✔	✔	✔	✔
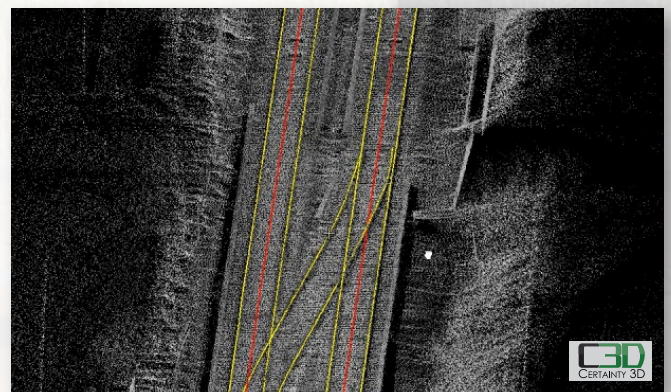
rail specific post processing with various third party software packages possible (shown example data: TopoDOT)

RIEGL VMX-RAIL Components and Setup

protective housing for enhanced scan head protection (3x)

GNSS antenna

RIEGL VUX-1HA laser scanner (3x)

VMX-RAIL-MH Measuring Head

thermo-electronic elements and forced-air cooling

IMU

main electronic unit: IMU/GNSS electronics, distribution of power supply and synchronization signals, camera control unit, control electronics for thermo-electric elements

crane hook

shock absorbers

VMX-RAIL-RM Roof Mount

RIEGL VMX-RAIL System Block Diagram

RiACQUIRE

VMX-RAIL-CR
Control Rack

VMX-RAIL-MH
Measuring Head

Optional Cameras

Power Supply
rail car on-board
230 V AC (optional 110 V AC)

DMI
Distance Measurement Indicator

e.g. FLIR LADYBUG®5+ spherical camera system

e.g. *RIEGL* Cameras with 5 and 12 MP

RIEGL VMX-RAIL System Components

- **VMX-RAIL-MH:**
  temperature stabilized measuring head equipped with 3 *RIEGL* VUX-1HA scanners

- **VMX-RAIL-CR:**
  The control rack is the central unit for system operation and data recording. An uninterruptible power supply (UPS) ensures failsafe system operation.

- **VMX-RAIL-RM:**
  shock proof mounting element

- **VMX-RAIL-DMI:**
  optical DMI or integration of compatible on-board rotary wheel encoder

- **Options:**
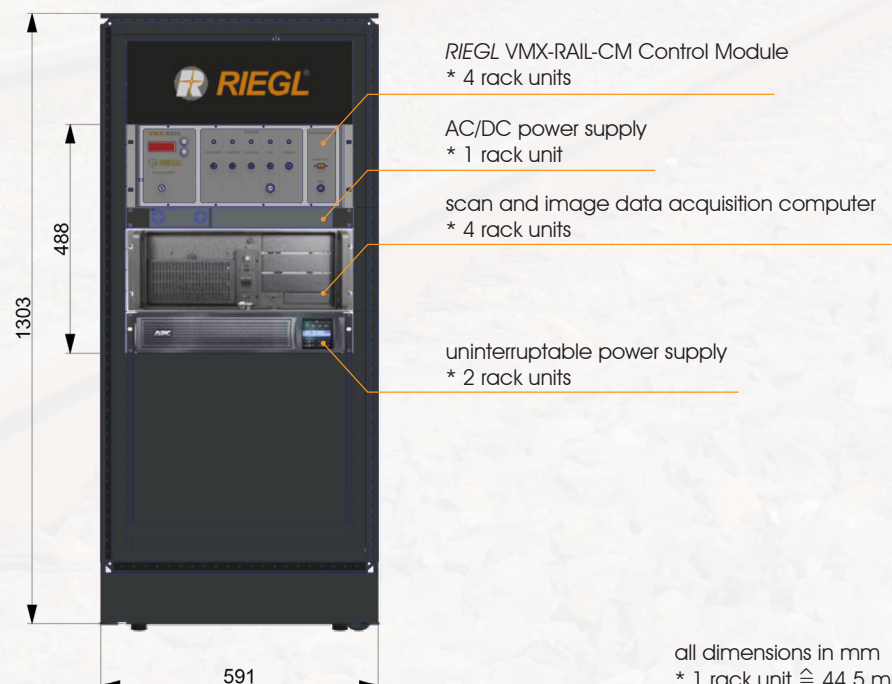 prepared for integration of up to 6 cameras
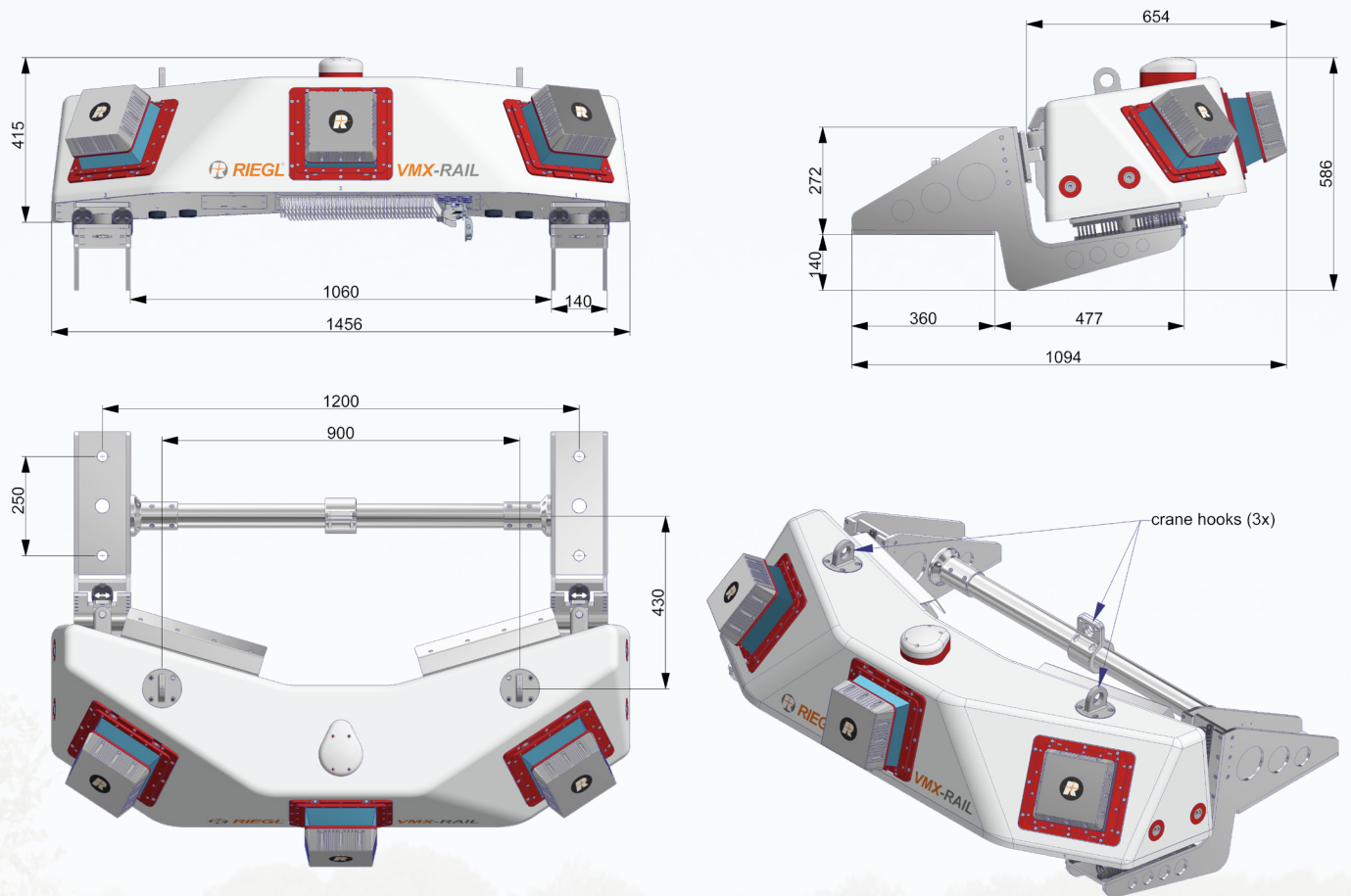
all dimensions in mm

Weight and Dimensions	Weight	Dimensions (L x W x H)
VMX-RAIL-MH Measuring Head	95 kg	654 x 1456 x 415 mm
VMX-RAIL-RM Roof Mount	30 kg	837 x 1340 x 412 mm
VMX-RAIL-CR Control Rack	76 kg	min. 500 mm stack space requirement in a 19" rack
VMX-RAIL-MC Main Cable	approx. 2 kg per meter	tailored cable length

RIEGL VMX-RAIL-CR

- 19 inch rack based control unit for fixed installation in a rail car
- The VMX-RAIL Main Cable is connected with a Harting® connector to the rear of the VMX-RAIL Control Rack.

RIEGL VMX-RAIL-CM Control Module
* 4 rack units

AC/DC power supply
* 1 rack unit

scan and image data acquisition computer
* 4 rack units

uninterruptable power supply
* 2 rack units

all dimensions in mm
* 1 rack unit ≙ 44,5 mm

RIEGL VMX-RAIL Technical Data

- **420m** max. measurement range
- **3 MHz** pulse repetition rate (peak)
- online waveform processing
- optional digital camera
- multiple target capability
- eye safe operation at Laser Class 1

VMX-RAIL Scanner Performance

Laser Class	Laser Class 1 (Class 1 Laser Product according to IEC 60825-1:2014)			
Effective Measurement Rate [1]	900 kHz	1.5 MHz	2.25 MHz	3 MHz
Max. Range, Target Reflectivity ρ ≥ 80% [2] [3]	420 m	330 m	270 m	235 m
Max. Range, Target Reflectivity ρ ≥ 10% [2] [3]	150 m	120 m	100 m	85 m
Max. Number of Targets per Pulse	practically unlimited (details on request)			
Minimum Range	1.2 m			
Accuracy [4] [6] / **Precision** [5] [6]	5 mm / 3 mm			
Field of View	360° "full circle"			
Scan Speed (selectable)	up to 750 scans/sec			

1) Rounded values, selectable by measurement program.
2) Typical values for average conditions. Maximum range is specified for flat targets with size in excess of the laser beam diameter, perpendicular angle of incidence, and for atmospheric visibility of 23 km. In bright sunlight, the max. range is shorter than under overcast sky.
3) Ambiguity to be resolved by post-processing with RiMTA software.
4) Accuracy is the degree of conformity of a measured quantity to its actual (true) value.
5) Precision, also called reproducibility or repeatability, is the degree to which further measurements show the same result.
6) One sigma @ 30 m range under *RIEGL* test conditions.

IMU/GNSS Performance [7]

Position Accuracy (absolute)	typ. 20 - 50 mm
Roll & Pitch Accuracy	0.005°
Heading Accuracy	0.015°

7) One sigma values, no GNSS outage, with DMI option, post-processed using base station data.

General Technical Data

VMX-RAIL-CR Power Supply Input Voltage	230 V AC (optionally 110 V AC)
Uninterruptable Power Supply (UPS)	failsafe operation by bridging power supply gaps for approx. 15 minutes in scanning mode and 35 minutes in standby mode
VMX-RAIL-MH Input Voltage	24 V DC (powered via VMX-RAIL-CR)
VMX-RAIL-CR typ. Power Consumption system operation without cameras additional power consumption per camera	typ. 750 W / max. 1020 W typ. 6 W / max. 30 W
Mounting Interface	4 x M24 threads
- VMX-RAIL-MH - VMX-RAIL-RM - shock absorbers between RM and MH - crane hooks	aluminium sand cast, powder-coated, with internal thermal insulation aluminium anodized wire rope springs stainless steel
Protection Class VMX-RAIL-MH	IP65
Temperature Range	-10°C up to +40°C (operation) / -20°C up to +50°C (storage)
Interface VMX-RAIL-CR to VMX-RAIL-MH	single main cable for power & data interface with robust Harting® connectors
Humidity Monitoring	4x desiccant cartridges with humidity indicator, valve for nitrogen purge

Data Interfaces

VMX-RAIL-MH

6 x multi-purpose ports supporting complementary camera systems and additional devices, each with
   - trigger pulse
   - precise time stamping of exposure pulse
   - NMEA data
   - PPS
   - LAN 1GigE
   - power 24 V DC, max. 30 W

VMX-RAIL-CR

1 x DMI input (for distance measuring indicator; odometer)
1 x NAV RS-232 (COM port for IMU/GNSS for RTK, SBAS)
1 x NAV RS-232 (COM output for synchronization of external device)
1 x AUX power supply output (+28V DC, max 30W)
1 x rack-based industrial PC with standard interfaces:
   -) LAN, 1000 Mbit/sec (e.g. to connect additional computer)
   -) USB 3.0 (e.g. image data transfer from FLIR Ladybug® 5)
   -) display port
   -) HDMI
3 x removable double SSD drive carrier with a total of 4.5TB swappable disc space

VMX-RAIL-MC (single cable connection between VMX-RAIL-MH and VMX-RAIL-CR) with 10 GigE Link

customized integration example

RIEGL **VMX-RAIL**
equipped with 3 VUX-1HA laser scanners

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